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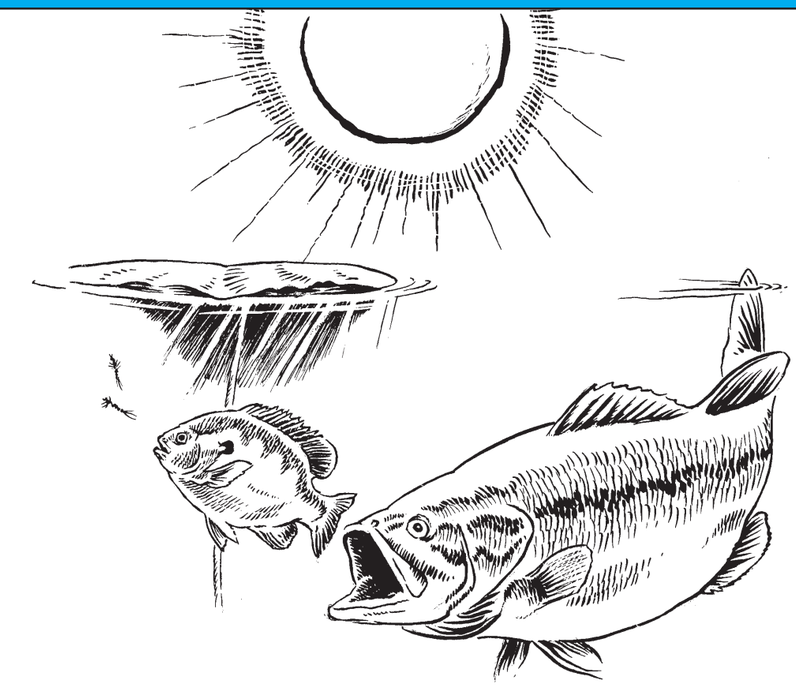
AQUAGUIDE
MISSOURI DEPARTMENT OF CONSERVATION

Fish Kills in Ponds and Lakes



Fish kills in ponds and lakes may occur at any time during the year from a variety of environmental and biological factors. Common causes of fish kills include summer and winter oxygen depletions, diseases and parasites, pollution, and thermal stress during breeding season. In some cases, there's not much that can be done to prevent fish kills. Proper construction, good watershed maintenance, and careful use of toxic materials in and around the pond, however, can go a long way toward preventing fish kills.

Common Causes of Fish Kills

Oxygen Depletion-Fish survive by "breathing" the oxygen dissolved in water. Oxygen concentrations, however, vary considerably depending on a number of factors including wind action on the water surface, the amount and type of vegetation, the time of day, water depth, and the temperature of the water. Ponds less than 8' deep are susceptible to fish kills because they may not have the volume of water needed to hold enough dissolved oxygen to support fish life throughout the year.

When oxygen levels in your pond get too low to support fish life, you probably will observe numbers of dead fish, and dying fish gasping for oxygen at the surface. Kills of this type normally take place over one to three days and typically first affect the largest fish. Small fish usually survive because they have a greater gill surface to body size ratio than do larger fish. This enables them to extract enough oxygen from low dissolved oxygen water to survive. Even though most of your large fish have been killed, it usually is not necessary to restock the pond. A more hands-on approach, however, to the management of

your pond, its watershed, and the remaining fish populations will be required.

Summer Kills- Warm water holds less dissolved oxygen than cool water. Anglers know that, as water warms, cold-blooded fish become more active. This activity comes with a price. They also require more oxygen. Pond waters are oxygenated in two ways; by mechanical and biological action. Mechanical aeration occurs naturally when wind disturbs the surface of the pond and oxygen is transported directly from the atmosphere to the upper layer of water. Biological oxygenation is the result of photosynthesis. One-celled phytoplankton, algae, rooted aquatic plants, and floating plants all produce oxygen as an end-product of the interaction of their green chloroplasts with sunlight. The amount of oxygen which is available to fish life in your pond is, as mentioned above, is also dependent on the temperature of the water.

At night, the photosynthetic process turns off in the absence of sunlight and the plant's respiratory cycle kicks-in. During respiration, oxygen introduced by wave action or produced during the day by plants is used by those same plants to fuel their internal processes and make carbon dioxide (CO^2). During still periods, ponds with heavy growths of rooted or floating aquatic plants, or algae blooms, may experience times just before dawn when dissolved oxygen levels are very low, or nonexistent. Fish are stressed, and may be killed if the new day is heavily overcast and the photosynthetic production of oxygen is delayed, or reduced. At the very least, rapid and dramatic swings in dissolved oxygen levels stress your fish and makes them more sensitive to diseases, parasites, and other environmental impacts.

The various species of algae live and grow in relatively narrow temperature ranges. As your pond warms in the spring, common species of algae die-off and are replaced by species more tolerant of warm water. The decay of a heavy "bloom" of algae uses up dissolved oxygen and stresses your fish. Worse, if you are unlucky enough to have a bloom of blue-green algae, the decay process releases toxic chemicals which also can kill your fish.

Summer oxygen depletions are common in ponds having heavy growths of aquatic plants. If more than 20% of the surface of your pond is covered by plants, you should give serious consideration to their control using biological, mechanical, or chemical treatments. Mechanical and biological control of aquatic plants is relatively safe and inexpensive. Chemical control can be both expensive and dangerous to yourself and your fish populations. You should always be careful to follow label directions and take all indicated safety precautions if you decide on a chemical treatment approach. Be careful to treat only about 1/3 of the affected area at any one time. Fuller treatments have the potential to kill too much vegetation which, during decay, may cause oxygen depletion.

See the following Aquaguides for details on mechanical, biological, and chemical control of aquatic plants: *Algae Control in Lakes and Ponds, Cattail and Water Primrose Control in Missouri Lakes and Ponds, Duckweed and Watermeal Control in Missouri Lakes and Ponds, Control of Aquatic Plants With Floating Leaves, Submerged Plant Control in Lakes and Ponds, and Grass Carp Control Weeds in Ponds and Lakes.*

If you do observe fish swimming at the surface gulping for air, a quick response may be necessary to save them. Mechanical aeration is most likely to provide a temporary solution to the problem. In small ponds, you can try to aerate the pond's surface waters with a boat and outboard motor. Be careful to keep the lower unit of the outboard motor in the water deeply enough to allow the water pump to operate and cool the engine. Be sure not to stir-up the sediment at the bottom of the pond.

Another method is to spray pond water into the air and let it fall back onto the surface. A third alternative is to use commercial aerators (commonly used in sewage lagoons) to aerate the surface of the pond. Regardless of which approach you try, there are no guarantees. The long-term solution to this problem is the proper management of your pond's watershed. In the short term, however, you will need to control the stand of aquatic plants in your pond.

Winter Kills- Fish are less active as water temperatures drop. If your pond becomes ice covered, mechanical aeration from wind action stops and only biological aeration persists. Heavy growths of aquatic plants in winter can be just as dangerous to fish life in the winter as they are in the summer. If the pond stays ice-covered for a considerable period of time, its bottom waters become depleted of oxygen from the decay of dead plants and other organic material just as it does in the summer. A "winter kill" of fish may result if heavy snowfalls block light penetration through the ice. Plants stop producing oxygen in the dark and oxygen levels are rapidly depleted. Clearing snow from the pond to permit light penetration may help avoid a "winter kill." Create 10 feet x 10 feet "windows" at a number of locations on the ice, the more the better. ***Be sure the ice is safe before clearing any "windows." If there is any doubt, don't go out onto the ice!*** In many cases, however, the first sign of a winter kill is a few dead fish floating in your pond after ice-melt. Contact your local Fisheries Management Biologist if you suspect that your pond has been winter killed.

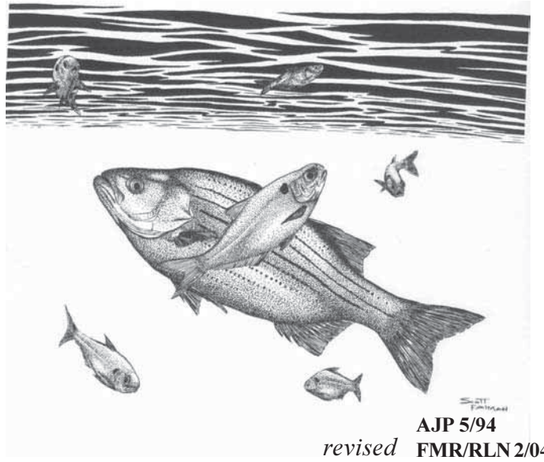
Winter may bring long periods of overcast weather, and aquatic plants may die-off. Aeration from wind action on the surface of an unfrozen pond, however, is usually sufficient to keep dissolved oxygen at tolerable levels and prevent fish kills.

Diseases- Most common fish diseases show themselves in the spring. Fish are in poor condition from their prolonged winter inactivity and, later, the stresses of spawning. While fish are in this weakened condition, many common soil and water bacteria are active, as are a variety of fish parasites. Fish are readily infected, and some may die. Typically, disease-caused fish kills take place over one to three weeks. Diseases rarely kill all fish in your pond. Fish populations rapidly rebound. Since it is impractical to treat the pond or the infected fish, your best approach to this problem is to properly manage the pond and its watershed. Catfish are particularly prone to disease if stocked at high densities. Always consult your Fisheries Management Biologist before making an initial stocking of catfish, or whenever you are considering supplemental stockings.

Thermal Stress- This cause of fish mortality is entirely weather dependent and there is nothing you can do to prevent it. Kills of this type are common in May or early June when bass and bluegill are "on the nest." Sudden periods of extremely hot, still, weather and bright sunlight rapidly elevates water temperatures in the shallows where fish are guarding their eggs. The fish are already stressed by spawning and guarding the nest, and the additional stress from the rapid change in water temperature appears to cause their deaths. Typically, only adult fish are killed.

Pollution- Most fish kills in private ponds are not caused by pollution. In some cases, however, runoff from feedlots, barnyards, crop fields, and lawns can carry toxic chemicals into the pond and kill fish and other aquatic life. Unlike kills caused by oxygen depletions, fish of all species and size are normally killed when this happens. Some fish, however, may be more sensitive to certain chemicals than are other fish. Among the materials which most commonly kill fish are ammonia from animal wastes, nitrogen fertilizers, and insecticides. Cattle recently "dusted" with insecticides should be kept out of ponds. Another chemical known to kill fish is Penta (pentachlorophenol), a common wood preservative. Always follow label directions when using any chemicals in the watershed of your pond.

Conclusion- Fish kills in ponds can result from both natural and man-caused influences. Your fish, however, don't have to be the victims. Maintaining a well vegetated watershed, particularly around the pond, adequate water depths, and controlling the density of aquatic plants will go a long way toward preventing fish kills in your pond. Please see the *Missouri Pond Handbook* for additional suggestions regarding management of your pond and its watershed. Contact your local Fisheries Management Biologist at the nearest Department of Conservation office for advice on managing aquatic plants and fish populations, or if you have experienced a fish kill.



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